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ABSTRACT

The research summarized in this paper was conducted on the Pine Ridge Indian Reservation in South Dakota. The purpose of the developmental study was to explore the cognitive aspect of development rather than to explore the personality as a whole. The Clinical Exploratory Method of Piaget was employed, which focuses primarily upon an experimental investigation of the qualitative development of intellectual structures, because it was expected that Piaget's system would be free of cultural bias. Some hypotheses tested were (1) Are Piaget's tests insensitive to basic differences in the sequence of stages of cognitive development? (2) Are there time delays or time advances in the population? and (3) Are time delays observed between ethnic groups consistent, or is a delay within one ethnic group offset by a relative advance in some other area? The methodology of this research consisted of adapting the interview to the reactions of the 75 Oglala Sioux children, aged 4 through 10, who were tested. The results indicated that the succession of stages described by Piaget is respected by both the Pine Ridge and the Geneva population. Further, there was shown to be no fundamental delay in the development of the basic processes in thinking among the population in Pine Ridge. It was also found that basic processes in cognition are more a function of an active organization process that the child brings upon his experience than is the role that language plays in the thought process. (HBC)

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TO THE READER: It should be recognized that many of the opinions expressed throughout this report are personal ones of the authors.

CROSS-CULTURAL STUDY OF COGNITIVE DEVELOPMENT ON THE PINE RIDGE INDIAN RESERVATION*

Acknowledgments

Our primary thanks and deep gratitude go to the Indian community on the Pine Ridge Reservation, without whose help, involvement, and commitment this study would not have been possible. Many people in the community have, in one way or another, contributed to this work and it would almost require a book to cite them all.

Specifically, however, we would like to thank those of the staff of the Community Mental Health Program whose help has been invaluable:

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NOTE: The Intention of this paper is to present a relatively short but accurate summary of the work that has been done at Pine Ridge. In the interest of brevity we have unfortunately found it necessary to eliminate, or to present in only skeleton form, some of the interesting historical and theoretical issues that are raised in the full report of which this is a review. Thus, the presentation here may tend to make overly simple some of the truly complex and multi-faceted points that are treated more broadly elsewhere.

Further, we have been unable here to present a detailed account of our experimental procedures and have chosen to devote more time in this limited discussion to our results and their meaning. The interested and concerned reader is urged to seek out the full text of this report for a more detailed and accurate discussion where we here may appear superficial and brief.

"But if the vision was true and mighty, as I know, it is true and mighty yet; for such things are of the spirit, and it is in the darkness of their eyes that men get lost".

<u>Black Elk Speaks</u>, p. 2;
University of Nebraska
Press, Lincoln: 1961 (1)

General Information

Almost from the first moment that man began to ask questions about the world around him, he has been concerned about the nature of the very process that allows him to do so. Man has long wondered about how we gain knowledge of our environment, how we learn, think, and reason; and also our potential for doing so. The first is essentially a question of the process, and for long has been a primary concern of the philosopher: We learn about how we think, by thinking about it.

Concern with our potential for thought and reason is essentially a question of the predicted outcome of our thinking, and as such has long been the domain of the psychologist: We learn about how well we think by using empirical devices which seek to measure the end-product of the process of thought. Thus, the tradition in psychology for evaluating one's ability to understand the world in which he lives, has been strongly in the camp of the IQ testers, and the way in which this potential has been evaluated is by measuring how much about the world one knows.

This distinction, although somewhat arbitrary, is extremely important. Many have tended to equate one's ability to think with his performance on an IQ test, (2) without understanding the problems that this raises. For one thing, whenever we seek to measure how much about the world one knows, and quantify this by comparing one person's performance to that of some reference group, we must squarely face the issue of the cultural embededness of the questions we ask. Is it a fair measure of how smart a child on the plains of South Dakota is, when we ask him why it is better to pay bills by check than by cash, when his home is one in which there is no water or floor, and he rarely has enough food to eat? Is it a fair appraisal of a child's social intelligence when we ask a child from New York City about the importance of the medicine man? For sure it is not, and yet there are far more subtle ways in which the cultural relativity of an IQ test result serves to obscure its meaning and its projected value. Let us say that there is considerable evidence to support the notion that IQ tests tend to be unfair to people whose cultural or sub-cultural milieu is sufficiently different from the one in which the test has been drawn.

Our first objection to an IQ test as a means of evaluating our ability to think, then, is its cultural embededness. But say, for the sake of underscoring our second point, that we could design an IQ test for each cultural and economic group, would this be sufficient? The answer is no, and the reason is that the very

nature of such a test is such that its results will leave us dry if our thirst is for an understanding of the way in which thought proceeds and grows. These tests are static, and tend to assume that throughout life the apparatus we have available for gaining knowledge remains qualitatively the same and only varies in the amount of information it can handle. They tend not to examine the available processes for thinking through development, and tell us little or nothing about the apparatuses or structures for thought. Is intelligence really nothing more than what an IQ test measures? And, more basically, what does an IQ test measure?

Suppose, on the other hand, we seek to appraise one's ability to think by inquiring about the availability of the processes and structures to his thought. In a rough way, the distinction here is the following: while the IQ tester would seek to evaluate a factory's ability to produce goods by examining the products, the approach we here discuss would hope to make such an appraisal by examining the machinery available, and all other factors that are relevant in the process of production itself. Interestingly enough, the available evidence suggests that when we take the approach to understanding the development of cognition that examines the dynamic processes available to us as we think, we may develop a theoretical point of view which not only tells us much about thinking, but one which is also culture-free. To these points we shall later return.

Thus, the methodology of the research we shall describe contrasts very much with the standard testing approach, because it is essentially exploratory rather than static, and allows us the essential flexibility demanded by work with different ethnic groups, personalities, or social environments. We have undertaken a developmental study which seeks not to explore personality as a whole but rather the cognitive aspect of development, and in which we employ the Clinical Exploratory Method of Piaget.

Introduction to Piaget's Approach

Let us begin to focus on some major aspects of Piaget's point of view by citing some examples of the issues it raises. For example, our system of counting has as its base the number 10. The very word, "decimal", and the use of the decimal point suggests the central role of "tens" as we count. One could devise a counting system with a different base, say, base 12, for example. Our system of telling time has 12 as its base; thus, when we read a clock and we add 2 hours to 11:00 we get 1:00. We see then that 11 plus 2 equals 1. Any such counting system could be devised,

and it just so happens that the ancient Mayas had a numerical system with a base 20 for calculations, instead of base 10 as we have. Most importantly though, the logic of the internal relations in all of these systems is precisely the same - the same among Mayas, among Whites, and among the clock watchers of the world. The logic of adding, of subtracting, and of other operations remains the same. Here is the important point. If we were to understand a concept like number, should we choose the system of the Mayas, the clocks, or some other arbitrary system determined by cultural preference; or should we seek to evaluate such notions by examining the basic logical properties which underlie them? In seems safe to assume that if we seek to evaluate the development of the concept of number, we must employ experiments dealing directly with number constructions. Again, the points are made that our approach should be one which seeks to evaluate the basic logical principles which underlie our ability to think, and thus both tell us much about how we think and our potential for thought, and yet remain culturally unbiased.

To further make the point of the danger of examining behavior on its manifest or its "product" level, let us cite another example for discussion. While some may say that a tepee is a primitive structure and the product of a mind not yet advanced to the level which conceives of a more modern structure as an ideal dwelling, we might point out that to see an Indian put up a tepee so that a sudden storm or blizzard will not move it, implies that he has a good grasp of the logic of spatial organization. It is its conic structure which confers stability, and this implies that the builder of the tepee has an empirical knowledge of principles of surface distribution and three-dimensional geometry. Thus, if the Mayas of long ago or contemporary Indian, White man, or anyone can build stable dwellings, can count, can trade and can share, we may infer the existence of basic logical invariances which are a product of the types of logical relations that are established between objects - and it is these basic logical structures which should be studied. This is one of the main aspects of a structural focus of the develop- of cognition rather than a simple behavioral one, and is the basic point which underlies Piaget's theories and thus our current work. Let us say that there are basic structures which underlie our ability to think, and the approach which to us seems most valuable in understanding both the nature of our thought and our capacity for thinking, seeks to focus on these very logical structures.

The Theoretical Framework

Thus, Piaget's point of view focuses primarily upon an experimental investigation of the qualitative development of intellectual structures. Importantly, the development of cognition

proceeds by the child's own actions on the world around him and involves the assimilation of the new into his existing structures and abilities, and the accomodation of these existing modes of operation to these new materials. The structures by which we function, change with development, and thus the way in which we organize our understanding of the world changes with development. In short, the child actively learns about his world, and the tools he has at his disposal are qualitatively different as he develops. The answer to the question, "How do we learn about and understand the world?", can only be obtained if we realize that at different times in our development we have different structures and therefore different capacities available to us.

Piaget has described the development of these capacities by reference to the progress of developmental stages which describe our growing apparatus for thought. (3) The child does not think the same way as the adult, he has different structures available to him. These stages are believed to proceed in an invariant way - the progression is always the same, and a later stage emerges by integration of the previous stage. Each stage is characterized by an initial period of formation and instability, and a final phase of achievement of that level of function. Furthermore, the existence of a certain stage implies its exclusiveness; the pre-operational child is not mostly pre-operational, he is entirely so. A particular stage represents a way to see reality which excludes any other way. This has critical implications for education, which we shall mention later.

There are, then, 4 stages in development. The first one, the period of sensory-motor intelligence, develops before language in the child and deals with a growing understanding of actions, their means, and their goals.

As language and the symbolic function emerges, sensory-motor intelligence becomes reorganized allowing the child to integrate symbols and expand his range of operations. This is the pre-operational stage of development and is characterized by the child's ego-centric point of view. Intelligence is mediated through language, but the child can not yet deal with abstractions that have a constant meaning. He has not yet understood such "constancies" of the real world as mass, measure, motion, and logical classes.

The following stage is characterized by the development of concrete operations. The child's thought becomes increasingly objective as he develops an understanding of various constancies in mental function. The fact that the mass of an object remains constant, irrespective of its shape, is an example of one constancy

that develops here. The child no longer thinks only in terms of himself, but takes into account the limitations of the external, physical world. This stage is called "concrete " though, because the child's capacity for dealing with these constancies exists with respect only to tangible objects.

The final stage of intellectual development deals with the advent of formal thinking, and the child's increasing ability to abstract his thought from the real objects of his world and form not only the necessary relations between real objects as in the previous stage, but also all possible relations between real or imagined objects. He is no longer directed by concrete relations and has achieved mature, adult thought.

Thus, if this is Piaget's theory we must also expect that his experiments or tests are of their very nature hierarchical; they describe a progressive organization of individual potentiality. They provide a detailed analysis of the functioning of thinking. They qualify thinking, they do not quantify it. They always respect the intelligence of a given child. But before proceeding to the process and outcome of the Pine Ridge Study, let us pause for a clearly important question.

Although we have offered what should be both logical and psychological reasons for expecting that Piaget's system should be free of cultural bias, what are the facts? Does his system really offer a universal point of view? Although again, concern for space limits our depth of discussion, we might note that many cross-cultural studies have been made in the last ten years, and some are still in progress. Work has been carried out in Africa, Senegal, Iran, Algeria, and of course in Europe, the U.S., and Canada. (4) One might refer to the general reference list following this paper or to the longer edition of this monograph for a more detailed account, particularly of the work of Dr. M. Bovet in Algeria and Hyde in Aden. Suffice it to say that the many studies performed, although typically limited in the breadth of their scope, have time after time borne out the existence of Piaget's stages, and their invariant succession in development, although at times the acquisition of a stage may be delayed in time with respect to Geneva norms. A child may develop a certain ability, a certain structure, earlier or later than a second child, but in normal development both youngsters will pass through an identical sequence of stages, be one in Geneva and the second in an African jungle. Further epistemological implications of Piaget's theory and the relevance of cross-cultural studies are discussed at length in our original presentation, but omitted here.

Let us turn now to a brief description of the community at Pine Ridge, and then discuss our study.

The Community

Again, the interested reader is referred to our broader text for a more nearly adequate picture of the community and its history. Briefly, though, the Pine Ridge Reservation lies on the rolling plains of southwestern South Dakota in an area not long ago roamed by wild buffalo and brave hunters, but now the home of some 10,000 Oglala Sioux whose largest remaining fight is against widespread illness and abysmal poverty. The reservation is the second largest in the U.S. and encompasses some 4,353 square miles. The beauty of the reservation, its quiet and open space, the stark stillness of the Bad Lands, the primitiveness of the prairie and its interlacing creeks, is also its problem, for in its relative isolation and under-development the reservation can supply meaningful support only to a handful. (5)

The people on Pine Ridge are very poor. Little of the land is arable and there are few jobs. Two thirds of the reservation households have a self reported total yearly income (including welfare) of less than $3,000.00 and one out of every three households a total of less than $1,000.00, while the average Indian household consists of 5.39 persons compared with 3.39 persons in the United States as a whole. The unemployment rate is over ten times the national rate. Over half the Pine Ridge Indians have a grammar school education or less, only 19% have completed high school, and the median number of years completed among Pine Ridge Indians is 8.7 compared with 12.0 for United States Whites and 9.0 for United States Negroes. Among Indians 25 and over, 81% left school before completing high school. The infant mortality rate is more than twice the national rate. The incident of tuberculosis is more than 15 times its incident in the United States general population. The birth rate is well over twice the national rate and the suicide attempt rate is approximately five times the national rate. (5).

Thus, we see a picture of poverty and illness, isolation and little hope. Erickson, in Childhood and Society (6) points out that this once-great nation has been plagued by "an apocalyptic sequence of catastrophies, as if nature and history had united for a total war on their too manly off-spring" (p. 116).

Indeed, history has been hard on the Sioux, for it was just over 90 years ago that the strength and determination of their bands led by Crazy Horse, Sitting Bull, Gall, Black Moon, and Big Road resoundingly defeated General Custer at the Little Big Horn.

The years that followed Custer's defeat were marked by increasing pressure by the U.S. military and systematic attempts to confine the Sioux to reservation life and deprive them of their material and cultural heritage.

Thus, some 80 years ago, a detachment of the 7th Cavalry was sent to meet and disarm Chief Big Foot at Wounded Knee on the Pine Ridge Reservation. When the smoke cleared, infants were frozen to death near their now-dead mothers, and some 183 men, women and infants had been "quieted" by the troops. But the tragedy at Wounded Knee - the last of the Indian Wars - scored far deeper than a simple death toll can tell, for it was the death of the hope that the old days would return and the traditional life continue.

Government policy over the last 70 years has been inconsistent, and has left the people distrustful but dependent. The Indian today has little trust in the government and often less trust in himself.

Today on the Reservation, slightly over half the population is Mixed Blood, the remainder being Full Blood. The difference is more than one of blood quantum, for one sees differences in the degree to which contemporary middle class values are embraced. Some 50% of the people live in small villages, while 15% live in small rural clusters and 35% live in isolated houses in the country. About 25% of the adult population speaks only English or mostly English, about 68% are bilingual and about 8% speak mostly or only Lakota. (5)

The population is an extremely youthful one; the median age amongst Indians is 16.7 years. About two-thirds of the population is under 25, and 53% of the population is under 18 years of age. (5)

About half of the Indian homes have only one or two rooms, only 40% of them have water piped into the house, and only 40% of Full Blood and 80% of Mixed Blood homes have electricity. In general, the economic conditions render the people of the Pine Ridge Reservation amongst the most underprivileged in the country. (5)

It is no surprise then that over one-quarter of the youngsters on the Reservation are at least 2 years older than the normal age for their grade. 81% of the people now over 25 years of age have not completed high school.(5) More than 70% of the children now completing the 8th grade will not finish high school, and about half of that number will likely drop out before completing the 9th grade. Over one-fifth of the population of 16 and 17 year-olds has already dropped out of school.

To what can we attribute the relative lowering of academic success? The question is certainly complex, but certainly one aspect of the situation is the lack of sufficient motivation to do well. Also, the Indian youth feels inferior and powerless and may fear the school environment. Parents typically remain rather passive with respect to enforcing school attendance for their children, and in the classroom itself there are certain cultural barriers between teacher and pupil which serve to inhibit success in school.

On the more positive side, there is more to formal learning than the academic stuff of school. Thus bravery, generosity, fortitude, and integrity are not taught at school but yet constitute a great part of Indian education. Piaget has pointed out that identification with such a value system formally implies a high level of thinking. When we consider problems in the development of the ability to think, we need to consider more than reading, writing, and arithmetic.

The Pine Ridge Developmental Study: Formal Approach

General

There are at least two ways to proceed in order to get a fair idea of cognitive development within a population, one quantitative, the other qualitative. Under usual circumstances, the first approach demands that we see many subjects so that precise numerical results may be obtained. The usual consequence is that one explores only a very few realms of cognition, to save an enormous task.

We have chosen the qualitative approach, which sacrifices precise numerical data, but affords us an overall picture of the development of several basic domains of thought. In that sense, this study has sought to cover a broader area of the genesis of cognition than any known previous cross-cultural study.

In our study we have selected for observation the acquisition of basic invariances - the constancies of mass, liquid (volume), weight, length, and 1:1 correspondence; the development of ordered notions of space - geometrical drawings, and the landscape rotation experiment; and the acquisition of principles of elementary logic - class inclusion and the development of ordering relations, seriation.

As noted above, it is critical for the development of the capacity to reason and to think that the child acquire awareness of the limitations of the external, physical world. A significant contribution to this growing objectivity in thought is the development of the notion that although certain aspects of a situation may change, there remain certain invariant qualities that must

be understood. These experiments, then, in conservation tap a range of truly basic principles in thought.

In addition, we may distinguish 2 basic processes in cognitive development, the logical and infra-logical operations. Logical processes deal with our ability to classify and order, they are discontinuous and give rise to concepts of number. Infra-logical processes deal with notions of space, time, and speed; they reflect continuous properties and give rise to notions of measure.

It is quite important to evaluate a broad array of functions, for an isolated operation is never sufficient to understand a stage of development. A stage is formed and identified by an interlacing of many operations that stand together and form a totality - a unified structure. The point is that one cannot at all get an adequate picture of an individual's level of function unless many attributes of function are evaluated.

Thus, in designing our present research with the intent of examining many areas of cognition, we were really getting at 2 points. One concern was to analyze the acquisition of the developmental stages in various realms, to be then compared to our norms for Geneva. Secondly, we hoped to validate the very notion of stages itself, for with the awareness that we can never talk of an isolated operation but only of an interlacing of operations, it becomes clear that the very fact that we could observe such operations or not - not only in one given realm but in general - tends to validate the idea of stages itself.

Statement of Hypotheses

Given the ethnic group under study and recognizing that the standard tests have assessed relative inferiorities in achievement, can we expect that these inferiorities reflect some delay in the most fundamental and basic processes in the development of thinking?

If we do find that the stages are respected in their sequence, is it simply because Piaget's tests are insensitive to basic differences in development, or indeed, that the developmental sequence is identical? Is it true or not that Piaget's tests are more basic than the more commonly used techniques?

Although cross-cultural studies have shown that the sequence of the development of stages is respected, the precise time at which they appear my vary. Will we find time delays or time advances in our population?

The fourth hypothesis concerns the relationship of language to cognition. Lakota has no verbal form defining a past or future tense. Spatial operations are related to the ability to differentiate coordinates in time. Thus, one could argue that a cultural group whose language does not facilitate spatio-temporal differentiation would have a parallel difficulty in dealing with spatial organization. However, if this is not true, then we would have demonstrated that abilities such as classification, seriation, and spatial coordination, would then seem to be dependent upon an origin which is neither perceptual nor linguistic, but - as Piaget notes - dependent upon early sensory-motor experience. We would appear to have shown that language is <u>not</u> one of the main factors in the development of thinking - although it helps, it is not everything.

In two experiments, we took the liberty of changing the usual procedure so that we might additionally get information on learning abilities; one of these experiments was related to spatial abilities, the other to elementary logic. We thus seek to assess individual potentialities to integrate a particular type of learning. We also seek to understand the relationship between different modes of learning and the stages of cognitive development - what can a child learn, and what can he not learn at a particular stage of development. The hypothesis concerns learning ability and the child's organizational structure.

The final hypothesis deals with specific achievements for particular notions, and the question of time delays that are observed between ethnic groups. We seek to evaluate the consistency of achievement <u>within</u> one logical realm, such as conservation. Will we find the same time delays that have been observed elsewhere? We would like to compare achievements between logical realms and between ethnic groups: are the achievements super-imposable, is a delay within one ethnic group offset by a relative advance in some other area?

<u>Population</u>

After a series of meetings with government and school personnel and interested parents, in which our proposal was made and discussed, final plans were drawn for the experimentation phase of our work. While it is not possible here to detail the process by which people were informed and youngsters selected, suffice it to say that within informal limits the subjects were selected without special concern for any special problems or abilities, and ultimately constituted a sample of 75 subjects, at least 10 at each age level from 4 through 10 years. Children were selected from Wakpamni, White Clay, and Wounded Knee Districts, and our sample was representative of the total population with respect to age and sex distribution, percentage of Mixed Blood and Full Bloods, household language preference, and the availability of electricity and running water in the house-

hold. Note with respect to language preference that it was sometimes necessary to administer our tests in Lakota, through a translator. Furthermore, virtually all of the testing was done in the school room or Head Start setting of the community in which the child lived.

Results

Again, we cannot here present an adequate account of the detailed experimental procedure or the formal analysis of results, and the interested reader is urged to seek the full report. Let us first offer some general aspects of Piaget's Clinical Method, then give a short statement of the kind of experiments performed and the results obtained for each.

The methodology of this research contrasts very sharply with the standard testing approach, because it is essentially exploratory rather than static. Essential to the technique is its flexibility, which consists of adapting the interview to the reactions of the child, in an attempt to follow his thinking process at each moment. Yet there is a basic, prescribed format, one which must be followed, and one which can be learned.

It is, then, central that the experimenter does not seek to distort the child's views by imposing his own order, but rather that he follows the child, his words, his actions, his intent. A more detailed outline of the Clinical Method can be found in our full presentation. Its particular strong points, however, are that (a) it tends to stimulate favorable motivation in the child, (b) in its flexibility, one can often obtain valuable information on the validity and reliability of the results with a particular child, (c) by varying the way or the order in which questions are asked, we may be sure that the child has understood what he is asked, (d) with certain children, certain parts of the experiment can be avoided when one has no question as to the validity of the results, (e) when once the child gives a response he is asked for a justification - this is central because it tells us much about the processes involved in his response, (f) to further establish the validity of a result, we employ the method of the Counter-Proof - we see the degree of conviction that the child has in forming his response and maintaining it it in the face of an opposite response, (g) protocols contain not only the child's verbal response, but also his movements and anything else he may have done.

Our analysis of results has essentially two parts. For each experiment, the first analysis is qualitative and is devoted to an analysis of the succession of stages through the various age groups of our sample, and the second part provides a rough comparison of

ages of attainment of the various stages between our Pine Ridge sample and Geneva. It must be remembered that our sample was relatively small, and thus, that these quantitative comparisons are only rough approximations. Our analysis is also quantitative in the sense that we have frequently used a Guttman analysis - a statistical technique which has previously proved extremely helpful in assessing the concept and continuity of stages. Then let us proceed.

Logical Realm: Conservation of Matter (7)

In this experiment which seeks to assess the attainment of one of the basic logical constancies, the child is presented with 2 balls of clay which are adjusted to equal mass, to the child's satisfaction. Through a prescribed program, one of the balls is varied in shape while one maintains its shape, and the child is variously asked, in an appropriate manner, if the matter has been conserved.

The results here clearly indicate the developmental stages of which Piaget has spoken. Stage 1 is characterized by no conservation, and the "quantity" of matter is seen as changing with its shape. In stage 2, the child vascillates between conservatory and non-conservatory responses. The child alternately affirms and negates the conservation; this is usual between ages 6 and 8. In stage 3, conservation is seen as a logical necessity. The child may justify his conservatory answer in any of 3 ways (a) identity - the clay is the same clay as before, (b) compensation - the clay is longer now, but it is also skinnier, (c) reversibility - if you put the clay back into the shape of a ball, you'll see it's the same. We note that these stages clearly exist, and that their succession is precisely the same as found elsewhere. We find pre-operational, transitional, and operational responses, and they appear to occur at the same age in development as found in Geneva.

Conservation of Liquid (8)

In this experiment, the child first is found to agree to the equality of two quantities of liquid, and then one of them is alternatively poured into various shaped and various numbers of containers and the child is questioned about the constancy of the equality of the liquids.

Here, too, three stages were found in the attainment of conservation, precisely paralleling the results found in Matter, and similarly the results found for Liquid, in Geneva. There is a complete succession of stages and these are qualitatively the same as those found in Geneva - this is the important fact. With respect to the

age attainment of conservation of liquid as a logical necessity, there appears to be a time delay of about one year for Oglala children; this is discussed more fully.

Conservation of Weight (9)

The techniques of this experiment parallel those in the Matter experiment, except here a Roman scale is presented and the child is queried about the constancy of weight as the shape of one of the clay balls is varied. It had been found in Geneva that this conservation is attained significantly later than conservation of matter.

In our sample we have found not only the same succession of stages and precisely the same justifications used for attainment as found above, but note that this is in full agreement with Genevan results. We further note the same time delay between the attainment of Matter and the attainment of Weight.

Conservation of Length (10)

This is an experiment in which 4 sticks are presented to the child and he is asked to select the two of equal length. With this done, the position of the 2 sticks relative to one another is altered in a prescribed manner, and the child is variously asked if the sticks are still of equal length.

Here, too, three stages in attainment were found, and the kinds of errors made by our subjects were precisely the same as those made by Geneva children. The succession of stages precisely paralleled that of the Geneva youngsters, and the age of attainment, although again tentative, seemed quite comparable as well. It is interesting to note here that although from a perceptual point of view the 2 sticks were clearly always equal in length, this conservation is not attained until about 8 or 9 years. The reason is that conservation is really not a perceptual affair and that the abstraction of an operation which seems to be perceptually easy is not al all easy for a child who does not think in operational terms. This point has direct pedagogical implications and will be discussed more fully in that section.

One to One Correspondence (11)

This is a kind of conservation of number experiment in which after the child establishes an equivalence in number between 2 groups of objects, the groups are alternatively displaced in space and the child is asked essentially if the equivalence of number has been preserved.

In the first stage, characteristic of 3 - 4 year olds, the child cannot understand the notion of equivalence and there is no conservation. In the second stage, the child can establish equivalence by direct perceptual comparison, but has not yet developed the notion that the number of elements is an abstraction which exists independently of its spatial displacement - he has no conservation. By 6, 7, and 8, the child can both establish the equivalence and demonstrate conservation. Here again we note that the Oglala children demonstrate precisely the same sequence in the attainment of this invariance as do Geneva youngsters.

In summary, then, the five experiments dealing with the logical realm of conservation display a picture of similarities of development between Oglala and Geneva. In the full report, some of the theoretical implications of the process by which conservation is gained, are discussed.

Logical Realm: Spatial Relationships (12)

Geometrical Drawings. In this experiment the child is asked to copy a series of 21 drawings which are intended to tap the child's sense of topological and Euclidean relations. It has been found particularly discriminative in 3, 4, and 5-year olds.

At stage 1a, the child begins to come under the influence of the model, and begins to differentiate the concepts of "open" and "closed". At 1b, we observe clear indication of topological relations (eg., opened, closed, etc.) but Euclidean relations (eg., circle, square, etc.) are not mastered. Stage 2 is marked by the increasing differentiation of Euclidean forms, through two substages. Stage 3 is marked by complete success, including forms which require a mastery of both topological and Euclidean relations.

In short, here, too, the existence and succession of stages precisely parallel Geneva Findings - Guttman analysis reveals not only the succession of stages, but also their hierarchical integration: Once a particular level is achieved, all previous levels have been attained. It is additionally pointed out that this experiment proved extremely useful for children who do not talk. Further, the experiment could well be given without a word from the examiner and it can be said that experimenter influence certainly does not interfere with the subject's performance here.

Rotation of Landscape - Coordination of Perspectives (13)

In this experiment, both the experimenter and the child have a board onto which is placed a tree, house, horse, and lion. In part one of the experiment the child and examiner sit side by side,

the latter constructs some combination of house, horse, and tree, and then places the lion at the edge of the board. The child's task is to construct his pieces so that his lion sees the same as the experimenter's. Next, the child and examiner sit at right angles, the task is the same, and the examiner's board is variously rotated in 90° increments through 4 rotations. In part two, the landscape remains fixed, but the lion - or reference point - varies through 4 rotations. In part three, the lion is placed at the corner of the board, and the point of view is from the diagonal.

Our results showed 3 stages in the acquisition and coordination of perspectives and spatial relationships. Stage 1 is characterized by an incapacity to understand the problem. In stage 2, we find two substages through which the child passes, the first marked by a completely ego-centric point of view, the second marked by attempts at differentiating between what the subject sees and what the experimenter sees, but with the subject often falling back into an ego-centric point of view. Stage 3 is characterized by differentiation and increasing coordination of perspectives - the child demonstrates an increasing ability to remove himself in thought from his concrete point of view and <u>imagine</u> what the board must look like from other points of view - a beginning of formal operations.

Let us emphasize again that the performance of the Oglala children and the Geneva children are quite comparable, both in the stages through which they pass and the precise sequence of these stages. The analysis and discussion of this experiment in our full report focuses on many critical tasks that are asked of the subject as he passes through the full series of transformations of the landscape. With these results analyzed with respect to the kinds of tasks required of the subject, we find again direct comparability of results between ethnic groups.

Significantly, too, when the learning aspects of this experiment are analyzed, we note a complete correspondence between the kind of learning a child can do and the cognitive level on which he functions. If a child is unable to function on an operative level of thinking, he is not likely to manifest learning which is better than his functional level allows him. Furthermore, if we find such a high correlation between modality of learning, level of cognitive function, and spatial relations, we can clearly say that the attainment of such spatial relationships is not simply perceptual, but reflects deep cognitive structures. Thus, even if the correct solution were offered to the child, he would only make use of it if his cognitive development has achieved a level where he can effectively make use of it - he can learn only when he is cognitively ready to learn. This section on spatial relations in the full report is a very important one, and should be carefully studied by the interested reader. In short, we have shown that <u>the development of space is not space perception, but space representation</u>.

Development of Elementary Logic: Inclusion of Class (14)

The child is presented with 12 horses and 2 lions, and his notions of class inclusion are examined through various levels. The child's appreciation of the notion that there will always be more members of a general class than any of its subclasses is examined (eg., Are there more animals or more horses?).

Three stages were isolated; in stage 1, inclusion is failed, the child's understanding of class membership is dominated by perception and the child is unable to make logical classifications. In stage 2, the child still has difficulty in understanding the defining characteristic of a class and in its extension, and his level of success varies. In the final stage we observe logical classification in which the child can coordinate the extension and comprehension of a class.

Here, too, we observe a regular sequential evolution of stages and one in which the Oglala and Geneva data are highly comparable. Our findings seem to indicate that logical classification is an operational concept, rather than a linguistic one.

Seriation (15)

A group of 10 graduated sticks is given to the child and he is asked to build a staircase - to arrange them from smallest to largest. With this done, he is asked to find the place for an 11th stick, one of intermediate length. We found 3 stages in the acquisition of seriation. In stage 1 the child fails although in 1b, he may demonstrate groups of pairs in which the pairs are organized by "bigger-smaller", but there is no coordination of groups. In stage 2 the child constructs small series, and may ultimately arrive at the total ordering, but the solution is perceptual. In the final stage, the child succeeds, and it is an operatory success. In comparison to Geneva, we find the same succession of stages, and a close coordination of successes between samples. With respect to the learning aspect of this experiment, we note the same finding uncovered in space: The learning of which a child is capable depends upon his stage of development.

General Comment on Results

While there is much to say about our results and their theoretical implications, let us say in the interest of summary that the notion of a sequential unfolding of stages in cognitive development has been shown, an unfolding which parallels our theoretical expectations and other empirical findings. We will return to discuss our hypotheses after turning to some of the pedagogical implications of this work.

Pedagogical Implications

Again and again our results have revealed a deep relationship between operatory development and the available modes of learning. This deep relationship between the way in which a child integrates information and the stage of his operational development are more and more recognized as important for education, and yet there remains controversy about the possibility of teaching certain fundamental operations.

Most of the results of learning experiments have shown that logic as such cannot be taught. If a child is clearly pre-operational, there is little chance that he can be made to change his point of view. However, if he is in a transitional stage and vacillating, it is much easier to introduce and make him aware of other possibilities. In other words, the type of learning which works is one which pushes rather than one which seeks to formally change the point of view of the subject. Thus, the development of intelligence is not simply a product of formal learning, but rather one of the development of structures which allow for the attainment of new knowledge. These new structures seem to develop when the child becomes aware of the conflict or contradiction between what he is prepared to understand at a particular moment and certain exceptions of external reality. The child may then be in the position of seeking to reorganize his understanding to take account of this new awareness.

In other words, instead of directing learning towards the acquisition of new facts, one should emphasize in any teaching procedure the method by which a child is able to move towards a solution. Learning in this sense is more than a pouring of facts into the child; it is a methodological discovery as well as a progressive reorganization through which the child is able to overcome his own pre-operational manner of functioning.

Thus, the brief outline of practical suggestions that follow are particularly suited for the transitional stage of intelligence known as the pre-operational period.

Practical Recommendations: (16) Here again, the interested reader is urged to refer to the full text. No attempt is made here for completeness, but rather we shall just cite the kinds of issues that are more fully discussed in our complete report:

A. Logico-Mathematical Relationships

1. Classification: Games can be devised and routines organized around the idea of putting things together that belong together; either by grouping

identical objects, grouping by situational belonging (soap and washrag), grouping by function (chalk and crayon), grouping by abstract relation (long, short, color, material, etc.).

2. Seriation: To form series, the child must first be able to distinguish "big" from "small". Equipment in all the play areas can be provided in only two sizes, of great difference. When two sizes have been mastered, the environment can be enriched to provide varying degrees of "bigger" and "smaller".

3. Numbers: The first task is to help overcome the child's construction of number on the basis of the amount of space that an array of objects occupies. The first step may be through "provoked" or "forced" correspondence ("find enough roofs for the houses"). The next step may be linear ordering - children are asked to arrange a set of objects in a row just like the teacher's row, etc.

B. Conservation

The teaching strategy here is to facilitate notions of reversibility: Arrange items in a line, disarrange them, see that they can again be arranged in same order. Various methods are described to facilitate a child's understanding of the notion that transformations are reversible.

C. Infra-logical Relationships

1. Spatial Relations

a. Development of topological relations through a sequence of sensory-motor activity;

b. Development of static space into dynamic space - have child disassemble objects into component parts, then re-assemble.

c. Reconstruction of sensory-motor space on a representational level - (a) learn perception by touch, forcing child to develop a mental image of object, (b) variety of rhythmic activities in which child has to imitate teacher's movements to facilitate the development of mental representations of spatial displacements, etc.

2. Temporal Relations

a. Attempt made to structure the school day into time sequences (teach kids we do A before B before C, etc.); show that we drop ball before it bounces, etc.;

b. Concept of speed aided by acting slowly or fast in rhythmics.

D. General

There are several further implications that are discussed. This study clearly shows the importance of early pedagogical training (17) our 3, 4, and 5 year olds need supplementary training; most often, "mental retardation" means little more than an impoverished background. A further implication is the break-up of the grading system so that instead of competing in the classroom, children can cooperate with each other. For older children, one might introduce unstructured lab periods, where the child can actually experiment with his knowledge rather than having it displayed only verbally to him. Tests should be de-emphasized as should the values attached to them: They may be decent evaluative tools but are useless in generating realistic teaching procedures. Parents' interest in the education of their children should be stimulated not by giving them their grades, but by showing them what can be done in order to help the child develop. Again, our results clearly show that there are simply no intellectual reasons for the poor performance in school at Pine Ridge; for these student's tools for thought - their cognitive structures - develop quite normally. We must stress in education those techniques which, when appropriately applied, will help a child in the growth of his mechanisms for making sense of what he encounters.

Conclusion

Theoretical: Let us now survey our hypotheses:

There is no question that our results show that the succession of stages described by Piaget is respected by both the Pine Ridge and Geneva population. Thus, the same prerequisite concepts are achieved by Oglalas in the same way that they are among Genevan kids. Further, there was shown to be no fundamental delay in the development of the basic processes in thinking among our population in Pine Ridge.

It has been shown that our tests do embody basic underlying structures in cognition, and do not reflect culture.

We have no reason to believe that there are any real time delays in the acquisition of developmental stages amongst the Oglala children.

In our concern with examining the relationship between language and cognition, we find some interesting results. We find that, although language certainly plays a role in thought, basic processes in cognition seem even more to be a function of an active organization process that the child brings upon his experience.

Our results have shown that a deep relationship exists between the learning modality available to the child and the cognitive stage at which the child functions. Learning represents underlying organizational patterns and can be enhanced by favoring the development of underlying structure, not simply the addition of new facts. One of the major aims in education should be to create an openness to cognitive contradictions.

We have found similar time delays within this cultural group as found elsewhere. For example, the attainment of conservation of matter seems to precede conservation of weight as a logical necessity. Again, there seem to be no significant time delays between cultures.

A Plea for the Indian and Indianness

Our attempt has been to begin to show how Indian children develop and to help to provide some meaningful ways of implementing new pedagogical techniques based on this approach. This is the meaning of a new day which might come, a day when educational purposes will be meaningful and when relevant education will be provided for all children. We must attend to Indian values, but in order to do this successfully one must also understand what is common to all children. That which is common to all children seems more and more to be the logical operations of cognitive development which do not appear to be culturally based, but which develop according to an internal order which transcends culture.

Thus, we can distinguish two separate realms in teaching. One is the realm of history, that in which the cultural values are strongly implicated. The other realm is independent of the cultural background and implies the following of similar paths by all children in the development of a system for understanding reality. When, in our introduction, we insisted upon the presence of logical necessities, we sought to focus upon these logical necessities internal to the process of cognitive development.

It does not necessarily cost more money to provide for a meaningful education. What it costs is enthusiasm and belief on the part of the teacher - a knowledge that the situation of the Indian child is temporary. The problem in education and learning for the Indian child is not a cognitive one, but rather seems related to a whole host of socio-economic and cultural factors which exist both inside and out of the classroom. One can well give these children more or different teaching procedures, but unless the complex of social, economic, and psychological problems which face the Indian in reservation life are addressed, these efforts will have been in vain.

Yet there remains a psychological conquest which the Indian can make. It is this conquest which will enhance his Indianness and enhance those values which would make middle-class White America look culturally deprived. It is the synthesis between a meaningful cognitive development and integration of Indian values which will finally decide whether the Indian defeat at Wounded Knee will become only a regression in the service of further development. Let us hope for this synthesis, and do what we may to encourage it at the beginning of life, at the beginning of the educational process.

It is unfair to assess the capabilities of the reservation Indian by using tests which are unfair to his culture. IQ tests have been widely used, but if an IQ were based on Indian Winter Counts, rather than on White values, we would then see Whites appear disadvantaged and backward. There are no IQ tests for those types of values which are Indian. There are no tests to assess an interest in people rather than things. There are no tests to assess a strong feeling of belonging, of identity, of dignity, of a need to share; yet these are the types of "tests" for which the Indians are best suited, these are the kinds of developments which are indeed formally advanced, and these are the types of values to which we Non-Indians could well attend.

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